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YOSHIYUKI IMANAKA ET AL.

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For: HEAD SUBSTRATE HAVING
DATA MEMORY, PRINTING
HEAD, PRINTING APPARATUS
AND PRODUCING METHOD
THEREFOR

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SUBMISSION OF SWORN TRANSLATIONS

Sir:

Further to our Amendment dated November 22, 2002, Applicants enclose hereto sworn translations of Japanese applications 10-306179 and 10-306182, both of which were filed October 27, 1998, from which the present application claims priority.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address given below.

Respectfully submitted,

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This is to certify that the annexed is a true copy
of the following application as filed with this office.

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Application Number: Japanese Patent Application
No. 10-306179

Applicant(s): CANON KABUSHIKI KAISHA

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Commissioner,
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10-306179

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[Material] Specification 1

[Material] Drawings 1

[Material] Abstract 1

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[Title of the Invention]

HEAD SUBSTRATE AND PRODUCING METHOD THEREFOR, AND PRINTER

HEAD AND PRODUCING METHOD THEREFOR

[Claims]

[Claim 1] A head substrate, for a printer head
detachably mounted to a printer main body, characterized by
comprising:

a plurality of external connection terminals for
externally entering various signals and driving power;

printing execution means for performing a printing
operation in accordance with said various signals and said
driving power externally entered at said external
connection terminals;

data memory means for performing data writing and data
reading;

memory access means for writing data to said data
memory means in accordance with said various signals and
said driving power externally entered at said external
connection terminals, and for reading data from said data
memory means in accordance with said various signals;

terminal sharing means for connecting said memory
access means and said printing execution means to a common
external connection terminal; and

writing inhibition means for permanently disabling

said memory access means to write data to said data memory means.

[Claim 2]

A head substrate according to claim 1, wherein said writing inhibition means cuts off electric power wiring for supplying driving electric power for data writing from said external connection terminals to said memory access means.

[Claim 3]

A head substrate according to claim 1, wherein specified one of said external connection terminals externally receives an access permission signal for permitting the data writing, while said memory access means executes data writing into said data memory means upon externally receiving said access permission signal from said external connection terminal; and wherein said writing inhibition means cuts off signal wiring for supplying said access permission signal for data writing from said external connection terminal to said memory access means.

[Claim 4]

A head substrate according to one of claims 1 to 3, wherein said memory access means writes data of plural kinds in order into said data memory means; and wherein said writing inhibition means individually disables the overwriting of said data of plural kinds to write in order into said data memory means by said memory access means.

[Claim 5]

A head substrate according to one of claims 1 to 4, wherein at least a binary logic signal, the binary state of which corresponds to the presence or absence of the printing operation, a printing image signal and a printing clock signal are externally entered to said plurality of external connection terminals; wherein said printing execution means initiates the printing operation when said printing image signal and said printing clock signal are externally entered to said external connection terminals while said binary logic signal in a first state is externally entered; and wherein, when said binary logic signal in a second state is externally entered to said external connection terminals, said memory access means performs data writing and data reading relative to said data memory means at the timing corresponding to a memory clock.

[Claim 6]

A head substrate according to one of claims 1 to 5, wherein said printing execution means outputs a printing image signal serially entered to one specific external connection terminal; and wherein said memory access means writes, to said data memory means, write data serially received from said specific external connection terminal whereat said printing image signal is serially entered, and

serially outputs read data obtained from said data memory means to said specific external connection terminal whereat said printing image signal is serially entered.

[Claim 7]

A head substrate according to one of claims 1 to 5, wherein said printing execution means prints a printing image signal entered in parallel to multiple specific external connection terminals; and wherein said memory access means writes, to said data memory means, write data received in parallel from said specific external connection terminals whereat said printing image signal is entered in parallel, and outputs in parallel read data obtained from said data memory means to said specific external connection terminals whereat said printing image signal is entered in parallel.

[Claim 8]

A head substrate according to one of claims 1 to 7, wherein said terminal sharing means supplies said memory access means with said printing clock signal of said shift register as a memory clock signal.

[Claim 9]

A producing method for a head substrate, for a printer head detachably mounted to a printer main body, that includes

a plurality of external connection terminals for

externally entering various signals and driving power;
printing execution means for performing a
printing operation in accordance with said various signals
and said driving power externally entered at said external
connection terminals;

data memory means for performing data writing and
data reading;

memory access means for writing data to said data
memory means in accordance with said various signals and
said driving power externally entered at said external
connection terminals, and for reading data from said data
memory means in accordance with said various signals; and

terminal sharing means for connecting said memory
access means and said printing execution means to a common
external connection terminal, said method comprising the
step of:

permanently disabling said memory access means to
write data to said data memory means after said memory
access means has completed the data writing relative to
said data memory means.

[Claim 10]

A producing method according to claim 9, wherein
electric power wiring for supplying driving electric power
for data writing from said external connection terminals to
said memory access means is cut off in order to permanently

disable the data writing into said data memory means by said memory access means.

[Claim 11]

A producing method according to claim 9, wherein signal wiring connecting said external connection terminal, externally receiving an access permission signal for permitting the data writing, and said memory access means is cut off in order to permanently disable the data writing into said data memory means by said memory access means.

[Claim 12]

A producing method according to one of claims 9 to 11, whereby said memory access means sequentially writes multiple types of data to said data memory means; and wherein said memory access means disables said memory access means to overwrite said multiple types of data that have been sequentially written to said data memory means.

[Claim 13]

A printer head, which is detachably mounted to a printer main body and which comprises a head substrate according to one of claims 1 to 8.

[Claim 14]

A printer head, which is detachably mounted to a printer main body, characterized by comprising:

a plurality of external connection terminals for externally entering various signals and driving power;

printing execution means for performing a printing operation in accordance with said various signals and said driving power externally entered at said external connection terminals;

data memory means for performing data writing and data reading;

memory access means for writing data to said data memory means in accordance with said various signals and said driving power externally entered at said external connection terminals, and for reading data from said data memory means in accordance with said various signals;

terminal sharing means for connecting said memory access means and said printing execution means to a common external connection terminal; and

writing inhibition means for permanently disabling said memory access means to write data to said data memory means.

[Claim 15]

A producing method for a printer head, which is detachably mounted to a printer main body and which includes

a plurality of external connection terminals for externally entering various signals and driving power;

printing execution means for performing a printing operation in accordance with said various signals

and said driving power externally entered at said external connection terminals;

data memory means for performing data writing and data reading;

memory access means for writing data to said data memory means in accordance with said various signals and said driving power externally entered at said external connection terminals, and for reading data from said data memory means in accordance with said various signals; and

terminal sharing means for connecting said memory access means and said printing execution means to a common external connection terminal, said method comprising the step of:

permanently disabling said memory access means to write data to said data memory means after said memory access means has completed the data writing relative to said data memory means.

[Claim 16]

A producing method according to claim 15, wherein electric power wiring for supplying driving electric power for data writing from said external connection terminals to said memory access means is cut off in order to permanently disable the data writing into said data memory means by said memory access means.

[Claim 17]

A producing method according to claim 15, wherein signal wiring connecting said external connection terminal, externally receiving an access permission signal for permitting the data writing, and said memory access means is cut off in order to permanently disable the data writing into said data memory means by said memory access means.

[Claim 18]

A producing method according to one of claims 15 to 17, wherein said memory access means sequentially writes multiple types of data to said data memory means; and wherein said memory access means disables said memory access means to overwrite said multiple types of data that have been sequentially written to said data memory means.

[Claim 19]

A printer comprising:
a printer head according to claim 13 or 14;
printing input means for transmitting various signals to multiple external connection terminals of said printer head to permit printing execution means to perform a printing operation; and

memory reading means for transmitting various signals to said multiple external connection terminals of said printer head to permit said memory access means to perform data reading.

[Claim 20]

A printer according to claim 19, wherein said printer head includes a head substrate according to claim 5; wherein said printing input means transmits, individually to said external connection terminals of said printer head, various signals, such as a printing image signal and a printing clock signal, together with a binary logic signal in a first state; and wherein said memory reading means may transmit a memory clock signal, together with said binary logic signal in a second state, to said external connection terminals of said printer head.

[Claim 21]

A printer according to claim 19 or 20, wherein said printing input means serially transmits said printing image signal to one of said external connection terminals; and wherein said memory reading means transmits read data for said memory access means to said external connection terminal whereat said printing image signal is serially input.

[Claim 22]

A printer according to claim 19 or 20, wherein said printing input means transmits said printing image signal to one of said external connection terminals in parallel; and wherein said memory reading means transmits read data for said memory access means to said external connection terminal whereat said printing image signal is input in

parallel.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a head substrate wherein various film layers are laminated on one base substrate, a printer head utilizing such a head substrate, and a printer utilizing such a printer head.

[0002]

[Description of Prior Art]

There are already commercialized various printers, including such a printer having a replaceable printer head as an ink jet printer. As an example, in the ink jet printer, plural external connection terminals are provided in a printer main body and a printer head, and these terminals are mutually connected when the printer head is mounted on the printer main body.

[0003]

In such state, the printer main body can transfer various signals such as a printing image signal and a printing clock signal to the printer head, so that the printer head can execute the printing of the externally entered image signal at a timing corresponding to the printing clock signal.

[0004]

In such a printer with the replaceable printer head, it is now proposed to provide a printer head with various data such as ID (identification) data of the head in readable manner. For this purpose, it is proposed to provide a printer head with data memory means such as an EEPROM (Electrically Erasable Programmable Read Only Memory), as disclosed in the Japanese Patent Laid-Open Nos. 3-126560 and 8-177732 and the U.S. Patent Nos. 5,504,507 and 5,363,134.

[0005]

[Problem to be solved by the Invention]

This type of printer head can be interchangeable mounted on the printer main body and can also store various data by the data memory means in arbitrarily readable manner. However, in case the printer head is provided with the data memory means such as an EEPROM, it is necessary to provide the printer head and the printer main body with exclusive plural connection terminals for executing data writing and data reading relative to the memory.

[0006]

In this case, such configuration increases the dimension of the external connection terminals in the printer head and in the printer main body, with a loss in the productivity thereof.

[0007]

In case various signals are used commonly for the printing operation and the data writing/reading in/from the memory, data may be written by a noise generated in the course of the printing operation. In such case, the stored data are overwritten by the noise so that an error is generated in the data readout.

[0008]

In consideration of the foregoing, one object of the present invention is to provide a head substrate capable of avoiding unnecessary overwriting of the data stored in the data memory means even in case various signals are used in common for the printing operation and the data readout, a printer head utilizing such head substrate and a printer utilizing such printer head.

[0009]

[Means to solve the Problem]

According to the present invention, a head substrate, for a printer head detachably mounted to a printer main body, is characterized by comprising: a plurality of external connection terminals for externally entering various signals and driving power; printing execution means for performing a printing operation in accordance with the various signals and the driving power externally entered at the external connection terminals; data memory means for performing data writing and data reading; memory access

means for writing data to the data memory means in accordance with the various signals and the driving power externally entered at the external connection terminals, and for reading data from the data memory means in accordance with the various signals; terminal sharing means for connecting the memory access means and the printing execution means to a common external connection terminal; and writing inhibition means for permanently disabling the memory access means to write data to the data memory means.

[0010]

Therefore, when a printer head using the head substrate of this invention is mounted to a printer main body, at the execution of a printing operation various signals for the printing operation are externally transmitted from the printer main body to the external connection terminals of the head substrate, and the printing execution means can initiate the printing operation in accordance with these signals externally received. Similarly, at the execution of data reading, various memory access signals are externally transmitted from the printer main body to the external connection terminals of the head substrate, and the memory access means can read data stored in the data memory means in accordance with these signals externally received. Further, since the memory access means and the printing execution

means are connected to the common external connection terminal by the terminal sharing means, the number of external connection terminals can be reduced. A signal entered at the printing execution means would be carried as noise to the memory access means; however, when the printer head using the head substrate of the invention is mounted to the printer main body, the data writing into the data memory means by the memory access means is permanently disabled by the writing inhibition means. Thus, the data stored in the data memory means cannot be overwritten by a noise, eventually intruding into the memory access means from the external connection terminals in the course of the printing operation.

[0011]

In the above-described head substrate, the writing inhibition means may cut off the electric power wiring for supplying the driving electric power for data writing from the external connection terminals to the memory access means.

[0012]

In the above-described head substrate, a specified one of the external connection terminals may externally receive the access permission signal for permitting the data writing, while the memory access means executes data writing into the data memory means upon externally

receiving the access permission signal from the external connection terminal, and the writing inhibition means may cut off the signal wiring for supplying the access permission signal for data writing from the external connection terminal to the memory access means.

[0013]

In the above-described head substrate, the memory access means may write data of plural kinds in succession into the data memory means, and the writing inhibition means may individually disable the overwriting of the data of plural kinds writing in succession into the data memory means by the memory access means.

[0014]

In the above-described head substrate, at least a binary logic signal, the binary state of which corresponds to the presence or absence of the printing operation, a printing image signal and a printing clock signal may be externally entered to the plurality of external connection terminals; the printing execution means may initiate the printing operation when the printing image signal and the printing clock signal are externally entered to the external connection terminals while the binary logic signal in a first state is externally entered; and when the binary logic signal in a second state is externally entered to the external connection terminals, the memory access means may

perform data writing and data reading relative to the data memory means at the timing corresponding to a memory clock.

[0015]

In the above-described head substrate, the printing execution means may output a printing image signal serially entered to one specific external connection terminal; and the memory access means may write, to the data memory means, write data serially received from the specific external connection terminal whereat the printing image signal is serially entered, and may serially output read data obtained from the data memory means to the specific external connection terminal whereat the printing image signal is serially entered.

[0016]

In the above-described head substrate, the printing execution means may print a printing image signal entered in parallel to multiple specific external connection terminals; and the memory access means may write, to the data memory means, write data received in parallel from the specific external connection terminals whereat the printing image signal is entered in parallel, and may output in parallel read data obtained from the data memory means to the specific external connection terminals whereat the printing image signal is entered in parallel.

[0017]

In the above-described head substrate, the terminal sharing means may supply the memory access means with the printing clock signal of the shift register as a memory clock signal.

[0018]

According to the present invention, provided is a method for producing a head substrate, for a printer head detachably mounted to a printer main body, that includes a plurality of external connection terminals for externally entering various signals and driving power; printing execution means for performing a printing operation in accordance with the various signals and the driving power externally entered at the external connection terminals; data memory means for performing data writing and data reading; memory access means for writing data to the data memory means in accordance with the various signals and the driving power externally entered at the external connection terminals, and for reading data from the data memory means in accordance with the various signals; and terminal sharing means for connecting the memory access means and the printing execution means to a common external connection terminal, the method comprising the step of: permanently disabling the memory access means to write data to the data memory means after the memory access means has completed the data writing relative to the data memory

means.

[0019]

In the producing method for the above-described head substrate and printer head, the electric power wiring for supplying the driving electric power for data writing from the external connection terminals to the memory access means may be cut off in order to permanently disable the data writing into the data memory means by the memory access means.

[0020]

In the producing method for the above-described head substrate and printer head, the signal wiring connecting the external connection terminal, externally receiving the access permission signal for permitting the data writing, and the memory access means may be cut off in order to permanently disable the data writing into the data memory means by the memory access means.

[0021]

In the producing method for the above-described head substrate and printer head, the memory access means may sequentially write multiple types of data to the data memory means; and the memory access means may disable the memory access means to overwrite the multiple types of data that have been sequentially written to the data memory means.

[0022]

A printer head according to the present invention, which is detachably mounted to a printer main body, comprises a head substrate according to the invention.

[0023]

According to the present invention, provided is a method for producing a printer head, which is detachably mounted to a printer main body and which includes a plurality of external connection terminals for externally entering various signals and driving power; printing execution means for performing a printing operation in accordance with the various signals and the driving power externally entered at the external connection terminals; data memory means for performing data writing and data reading; memory access means for writing data to the data memory means in accordance with the various signals and the driving power externally entered at the external connection terminals, and for reading data from the data memory means in accordance with the various signals; and terminal sharing means for connecting the memory access means and the printing execution means to a common external connection terminal, the method comprising the step of: permanently disabling the memory access means to write data to the data memory means after the memory access means has completed the data writing relative to the data memory

means.

[0024]

In the producing method for the above-described printer head, the electric power wiring for supplying the driving electric power for data writing from the external connection terminals to the memory access means may be cut off in order to permanently disable the data writing into the data memory means by the memory access means.

[0025]

In the producing method for the above-described printer head, the signal wiring connecting the external connection terminal, externally receiving the access permission signal for permitting the data writing, and the memory access means may be cut off in order to permanently disable the data writing into the data memory means by the memory access means.

[0026]

In the producing method for the above-described printer head, the memory access means may sequentially write multiple types of data to the data memory means; and the memory access means may disable the memory access means to overwrite the multiple types of data that have been sequentially written to the data memory means.

[0027]

According to the present invention, a printer

comprises: a printer head according to the present invention; printing input means for transmitting various signals to multiple external connection terminals of the printer head to permit printing execution means to perform a printing operation; and memory reading means for transmitting various signals to the multiple external connection terminals of the printer head to permit the memory access means to perform data reading. Thus, the number of external connection terminals to be connected to the printer head can be reduced to implement the reduction of the size and the weight and the improvement of productivity, and the stored data can be always accurately read from the printer head.

[0028]

In the above described printer, the printing input means may transmit, individually to the external connection terminals of the printer head, various signals, such as a printing image signal and a printing clock signal, together with a binary logic signal in a first state; and the memory reading means may transmit a memory clock signal, together with the binary logic signal in a second state, to the external connection terminals of the printer head.

[0029]

According to the thus arranged printer, the printing input means may serially transmit the printing image signal

to one of the external connection terminals, and the memory reading means may transmit read data for the memory access means to the external connection terminal whereat the printing image signal is serially input.

[0030]

According to the thus arranged printer, the printing input means may transmit the printing image signal to one of the external connection terminals in parallel, and the memory reading means may transmit read data for the memory access means to the external connection terminal whereat the printing image signal is input in parallel.

[0031]

Various means referred to in the present invention may be suitably so formed as to realize their functions, and include, for example, an exclusive hardware, a computer provided with appropriate functions by a program, functions realized within a computer by an appropriate program, and combinations thereof.

[0032]

[Embodiments]

An embodiment of the present invention will be explained in the following, with reference to the attached drawings, in which Fig. 1 is a block diagram showing the circuit configuration of the head substrate in an embodiment of the present invention; Fig. 2 is an external

perspective view of a printer; Fig. 3 is a schematic block diagram showing the circuit configuration of the printer; and Fig. 4 is a schematic diagram showing a method for producing a printer head together with the usage state of the printer.

[0033]

As shown in Fig. 5, an image processing system 100 of the present embodiment is provided with a host computer 200 constituting a central processing unit and an ink jet printer 300 constituting a printing apparatus, which are connected through a communication cable 210.

[0034]

The ink jet printer 300 of the present embodiment is provided, as shown in Fig. 2, with a printer head 400, which is composed of a head substrate 401 and a cover member (not shown). As shown in Fig. 1, the head substrate 401 is provided with a base substrate 410, on the surface of which various members are formed with films and others.

[0035]

In the head substrate 401 of the present embodiment, the front edge portion of the surface of the base substrate 410 bears plural heater elements 411 as printing elements, constituting a heater portion 412. Ends of the plural heater elements 411 are connected respectively to the source electrodes of plural power transistors 413, which

constitute a driver circuit 414.

[0036]

The other ends of the plural heater elements 411 and the drain electrodes of the plural power transistors 413 are connected to a pair of heater power supply terminals 415, 416 constituting the external connection terminals and the gate electrodes of the plural power transistors 413 are electrically connected respectively to plural AND gates 418 of a heater logic circuit 417. The heater logic circuit 417, the driver circuit 414 and the heater unit 412 constitute printing execution means.

[0037]

The heater element 411 is composed of a film for example of tantalum nitride, tantalum-aluminum, tantalum-silicon nitride etc. and generates heat by a driving electric power supplied from the driver circuit 414 through the heater power supply terminals 415, 416.

[0038]

These plural AND gates 418 are matrix wired in plural control blocks, and plural block terminals 419 constituting the external connection terminals are connected to the plural AND gates 418 in each block. Also the plural AND gates 418 are connected to a pulse terminal 420 which is an external connection terminal, and to a latch circuit 421 which is connected in parallel to a shift register 422.

[0039]

The latch circuit 421 and the shift register 422 are connected in common to a reset terminal 423 constituting an external connection terminal, and also respectively connected to clock terminals 424, 425 constituting also the external connection terminals. The shift register 422 is also connected to a data terminal 426, which constitutes another external connection terminal.

[0040]

The block terminal 419 receives a selection signal for selecting the plural control blocks of the plural heater elements 411, while the pulse terminal 420 receives a printing pulse signal for controlling the heat generating time of the heater element 411. The reset terminal 423 receives a reset signal, for resetting the latch circuit 421 and the shift register 422, as a binary logic signal the binary state of which corresponds to the presence or absence of the printing operation.

[0041]

The clock terminal 424 receives a hold signal for determining an operating frequency for the data holding operation of the latch circuit 421, and the clock terminal 425 receives a printing clock signal for determining the frequency of data shifting in the shift register 422.

[0042]

The data terminal 426 receives a serial printing image signal, which is converted into by the shift register 422 into a parallel printing signal, which is temporarily held by the latch circuit 421 and is supplied through the AND gages 418 to the driver circuit 414, whereby the plural heater elements 411 generate heat corresponding the printing image signal.

[0043]

On the base substrate 410, there is also formed a sensor unit 430 composed of a temperature sensor and a temperature holding sensor, and the sensor unit 430 is connected to a pair of sensor terminals 431 constituting the external connection terminals. The external connection terminals also include a pair of power supply terminal 432, 433 which are connected to various units.

[0044]

The sensor unit 430 executes heating for heat-retaining of the base substrate 410 and measurement of temperature thereof, and the sensor terminal 431 receives a control signal for the sensor unit 430. Power supply terminals 432, 433 receive the driving electric power to be supplied to various units, including the heater logic circuit 417.

[0045]

In the head substrate 401 of the present embodiment,

there is formed a fuse ROM 441 as data memory means on the surface of the base substrate 410, and a fuse logic circuit 442 constituting memory access means is formed so as to surround the fuse ROM 441.

[0046]

Various data, such as the ID code of the printer head 400 and the function characteristics of the heater unit 412, are recorded in the fuse ROM 441 prior to the shipment, and the heater logic circuit 442 executes the data writing and the data reading, including the data writing and the data reading, to the fuse ROM 441. The fuse ROM 441 in the present embodiment is provided with a memory capacity of equal to or smaller than 100 bits, since the data to be stored therein are the ID code and the function characteristics as explained above.

[0047]

In the printer head 400 of the present embodiment, the fuse logic circuit 442 is connected in common to the aforementioned external connection terminals 423, 425, 426 connected to the printing logic circuit 417, through a signal wiring 444 constituting terminal sharing means.

[0048]

Consequently, the reset signal for the shift register 422 and the latch circuit 421, entered externally to the reset terminal 423, is also supplied to the fuse logic

circuit 442 through the signal wiring 444, whereby the fuse logic circuit 442 recognizes the reset signal of a second state as an access permission signal.

[0049]

Also the input signal for the shift register 422, entered externally to the clock terminal 425, is supplied as a memory clock signal to the fuse logic circuit 442, whereby the data read therefrom are serially transferred through a signal wiring 446 to the data terminal 426.

[0050]

The fuse logic circuit 442, being enabled for memory access to the fuse ROM 441 upon recognizing the access permission signal as explained above, reads the data stored in the fuse ROM 441 if the memory clock signal is externally entered in this state.

[0051]

The fuse logic circuit 442 is also connected to the pair of memory power supply terminals 447, 448 constituting external connection terminals, whereby the driving electric power required for the fuse logic circuit 442 in executing the data writing into the fuse ROM 441 is supplied from such memory power supply terminals 447, 448.

[0052]

However, an electric power fuse 449 constituting writing inhibition means is inserted in the electric power

wiring connecting the memory power supply terminals 447, 448 and the fuse logic circuit 442, and the connection between the memory power supply terminals 447, 448 and the fuse logic circuit 442 is cut off by the fused electric power fuse 449 at the shipment of the printer head 400, whereby the data writing by the fuse logic circuit 442, into the fuse ROM 441 is permanently disabled.

[0053]

For the head substrate 401 of this embodiment, a cover member is formed of a sealing member constituting partitions and a cover substrate. This cover member is adhered to the surface of the head substrate 401 to form, on the surface of the head substrate 401, nozzles corresponding to the heater elements, ink supply paths and an ink holding portion (not shown) including ink reservoirs, by the partitions of the sealing member.

[0054]

In the ink jet printer 300 of the present embodiment, the printer head 400 of the above-described configuration is detachably mounted, as shown in Figs. 4 and 5, on a carriage 303 of a head moving mechanism 302, and the carriage 303 is supported movably in the main scanning direction, for example by a guide shaft 304.

[0055]

The printer head 400 is provided with the plural

external connection terminals 415, ... as explained in the foregoing, and plural external connection terminals (not shown) of an corresponding arrangement are also provided on the carriage 303. Therefore, when the printer head 400 is mounted on the carriage 303, the plural external connection terminals 415, ... of the printer head 400 are respectively connected to those of the carriage 303.

[0056]

In a position opposed to the printer head 400 mounted on the carriage 303, there is provided a platen roller 305 for supporting and conveying a printing sheet P constituting the recording medium, and the platen roller 305, etc. constitute a sheet feeding mechanism 306 for conveying the printing sheet P in successive manner in the sub scanning direction.

[0057]

The head moving mechanism 302 and the sheet feeding mechanism 306 are connected to a movement control circuit 311, which is in turn connected to a microcomputer 312. The microcomputer 312 comprehensively controls the head moving mechanism 302 and the sheet feeding mechanism 306, thus constituting relative movement means for causing the surface of the printing sheet P to move relative to the ink discharging position of the printer head 400.

[0058]

The microcomputer 312 is also connected to a data input circuit 313 constituting printing input means, a data readout circuit 314 constituting access control means, a communication I/F 315, etc., and the host computer 200 is connected to the communication I/F 315 through the communication cable 210.

[0059]

The data input circuit 313 is connected to the heater logic circuit 417 of the printer head 400 through the carriage 303, and the data readout circuit 314 is connected to the fuse logic circuit 442 of the printer head 400 through a connector of the carriage 303.

[0060]

At the execution of image printing, the data input circuit 313 supplies the heater logic circuit 417 of the printer head 400 with a printing image signal, and, at the execution of image printing, the data readout circuit 314 reads the stored data of the fuse ROM 441 from the fuse logic circuit 442 of the printer head 400.

[0061]

For more detailed explanation, as is shown in Fig. 4, the data input circuit 313 retains the reset signal at the first (low) state at the execution of the image printing, and individually transmits the printing image signal and the printing clock signal thereby causing the heater logic

circuit 417 etc. to execute the printing operation.

[0062]

On the other hand, the data readout circuit 314 retains, at the execution of image printing, the reset signal at the second (high) state and transmits the memory clock signal, and serially receives the readout data serially transferred in synchronization therewith from the fuse logic circuit 442.

[0063]

When the reset signal is shifted to the high state, the shift register 422 and the latch circuit 421 are retained in a continued reset state, whereby the printing operation is not executed even if various signals are exchanged through the external connection terminals in such memory access state. As the fuse logic circuit 442 executes the data writing and data reading only when the memory clock signal is entered in the high state of the reset signal, the memory access is not executed during the execution of the printing operation.

[0064]

The microcomputer 312 comprehensively controls the circuits 311, 313 and 314, thereby supplying the printing image signal, entered from the host computer 200 to the communication I/F 315, to the data input circuit 313 and outputs the data, read by the data readout circuit 314 from

the printer head 400, to the host computer 200 through the communication I/F 315.

[0065]

The ink jet printer 300 of the present embodiment is also provided with an ink tank (not shown) constituting ink supply means, and such ink tank is connected to the ink supporting portion of the printer head 400 through a socket member (not shown) of the carriage 303. The ink tank is filled in advance with liquid ink and supplies the printer head 400 with such ink.

[0066]

In the image processing system 100 of the above-described configuration of the present embodiment, the host computer 200 supplies the ink jet printer 300 with the printing image signal, which is output by the ink jet printer 300 onto the printing sheet P.

[0067]

In this case, under the control by the microcomputer 312, the head moving mechanism 302 moves the printer head 400 in the main scanning direction, while the sheet feeding mechanism 306 moves the printing sheet P in the sub-scanning direction, and the data input circuit 313 enters the printing image signal into the printer head 400 in synchronization with these operations.

[0068]

The printer head 400 supports, in the ink supporting portions, the ink constantly supplied from the ink tank, and the heater logic circuit 417 selectively drives the plural heater elements 411 according to the entered printing image signal. The liquid ink in the ink supporting portion generate bubbles by the selective heat generation of the plural heater elements, whereby ink droplets are discharged and deposited onto the printing sheet P in relative movement, thereby forming a dot matrix image.

[0069]

In the image processing system 100 of the present embodiment, the printer head 400 is provided with the fuse ROM 441, and the ID code and the function characteristics of the heater unit 412 are recorded in the fuse ROM 441 at a time after the manufacture of the printer head 400 and prior to the shipment thereof.

[0070]

When the printer head 400, shipped after such data recording, is mounted in the ink jet printer 300, it is rendered capable, by the data readout circuit 314, of reading the stored data from the fuse ROM 441 of the printer head 400.

[0071]

The ink jet printer 300 is therefore rendered possible

to regulate the electric power supplied to the heater unit 412 according to the function characteristics thereof read from the fuse ROM 441 of the printer head 400 and to inform the host computer 200 of the ID code of the printer head 400.

[0072]

Also in the ink jet printer 300 of the present embodiment, the printer head 400 is provided with the fuse ROM 441 as explained in the foregoing, but the signals for access to such memory are entered by the external connection terminals 423, 425, 426 used for the printing operation.

[0073]

Therefore, it is not required to provide the printer head 400 with the additional terminals exclusive for the data writing and data reading relative to the fuse ROM 441, thereby allowing to reduce the dimension and weight of the printer head 400 and to improve the production capability thereof. Similarly it is not required to provide the carriage 300 with the additional terminals, so that the ink jet printer 300 can be realized more compact and lighter with improved production capability.

[0074]

As various signals in the printing operation are utilized for the signals for memory access as explained in

the foregoing, the data readout circuit 314 and the data input circuit 313 can be formed in common in a large proportion of the hardware in the ink jet printer 300, whereby the ink jet printer 300 can be simpler in structure and smaller in dimension and weight.

[0075]

In case the external connection terminals for the printer head 400 are used in common for the printing operation and for the memory access, the noise generated at the execution of the printing operation of the ink jet printer may intrude as writing data into the fuse logic circuit 442.

[0076]

However, in the printer head 400 of the present embodiment, as shown in Fig. 4, various data are written into the fuse ROM 441 by the fuse logic circuit 442 prior to the shipment of the printer head but the electric power fuse 449 is cut off at the shipment thereof.

[0077]

Therefore, in the printer head 400 shipped as the product, the driving electric power required for data writing cannot be supplied from the memory power supply terminals 447, 448 to the fuse logic circuit 442, so that the data writing by the fuse logic circuit 442 into the fuse ROM 441 is not realized even if a noise is generated

in the course of the printing operation.

[0078]

As aforementioned, in the ink jet printer 300 of the present embodiment, the data stored in the fuse ROM 441 of the printer head 400 cannot be overwritten by the noise, so that the necessary data stored in the fuse ROM 441 cannot be lost and can always be exactly read from the fuse ROM 441.

[0079]

The present invention is limited to the foregoing embodiment but includes various modifications within the scope of technical concept of the present invention. For example, the foregoing embodiment has shown an ink jet printer of electrothermal conversion type, but the present invention is applicable to the printer of various types in which the printer head is replaceable.

[0080]

Also in the foregoing embodiment, the ink jet printer 300 and the printer head 400 utilize a data terminal 426 for serially transferring the printing image signal and the data read from the fuse ROM 441, but these may be transferred in parallel through plural external connection terminals.

[0081]

Also in the foregoing embodiment, the fuse ROM 441 and

the fuse logic circuit 442 are formed, together with the heater unit 412 and the heater logic circuit 417, on a single base substrate 410 with layered structure, but it is also possible to mount an independent chip constituting the fuse ROM 441 or the fuse logic circuit 442 on the base substrate 410.

[0082]

Also in the foregoing embodiment, the reset signal for the shift register 422 and the latch circuit 421 is used as the access permission signal for the fuse logic circuit 442, but it is also possible to utilize the hold signal for the latch circuit 421, entered externally to the clock terminal 424, for this purpose.

[0083]

Also in the foregoing embodiment, the shift register 422 and the latch circuit 421 utilize a reset signal in common, but there may be employed separate signals for this purpose, and, in such case either of such signals may be utilized as the access permission signal for the fuse logic circuit 442.

[0084]

Also in the foregoing printer head 400, the presence or absence of the operation of the heater unit 412 is eventually determined by the presence or absence of the printing pulse signal externally entered into the pulse

terminal 420, so that it is possible to utilize various signals of the fuse logic circuit 417 for the memory access operation by terminating the printing pulse signal at the execution of the memory access.

[0085]

In the foregoing, it has been explained to write all the necessary data into the fuse ROM 441 and then to disable overwriting of all the data by fusing the electric power fuse 449. It is however also possible, as shown in Fig. 5, to write data of plural kinds in succession into the fuse ROM 441 and to individually disable overwriting of the written data of plural kinds in the order of writing. That is, when producing the head substrate, the writing of the ROM is disabled after writing the resistance value in the ROM. Then, after producing the head, the writing of the ROM is disabled after writing the head ID in the ROM. Such configuration can be realized by providing plural fuse ROM's 441 and plural electric power fuses 449.

[0086]

For example, as shown in Fig. 5, the function characteristics of the heater unit 412 are written and the overwriting is disabled in the fuse ROM 441 at the completion of the head substrate 410, and the head ID is written and the overwriting is disabled at the completion of the printer head 400. In this manner it is possible to

write various data at appropriate timings in non-rewritable manner, and the data of the function characteristics cannot be overwritten even if a noise is generated at the writing of the head ID.

[0087]

Also in the foregoing, it has been explained to cut off the power supply wiring between the fuse logic circuit 442 and the memory power supply terminals 447, 448 by the electric power fuse 449, in order to disable data overwriting of the fuse ROM 441 after the data writing. However, it is also possible to cut off the signal wiring for the access permission signal for data writing, in case the signal wiring for entering the access permission signal to the fuse logic circuit is provided separately for the data writing and for the data readout.

[0088]

[Advantage of the Invention]

The present invention, constructed as explained in the foregoing, further provides the following advantages.

[0089]

When a printer head using the head substrate of this invention is mounted to a printer main body, at the execution of a printing operation various signals for the printing operation are externally transmitted from the printer main body to the external connection terminals of

the head substrate, and the printing execution means can initiate the printing operation in accordance with these signals externally received. At the execution of data reading, various memory access signals are externally transmitted from the printer main body to the external connection terminals of the head substrate, and the memory access means can read data stored in the data memory means in accordance with these signals externally received. Further, since the memory access means and the printing execution means are connected to the common external connection terminal by the terminal sharing means, the number of external connection terminals can be reduced. A signal entered at the printing execution means would be carried as noise to the memory access means; however, as the data writing into the data memory means by the memory access means is permanently disabled by the writing inhibition means, the data stored in the data memory means cannot be overwritten by a noise, eventually intruding into the memory access means from the external connection terminals in the course of the printing operation, and necessary data cannot be lost and can always be read exactly.

[0090]

In the above-described head substrate, the writing inhibition means cuts off the electric power wiring for

supplying the driving electric power for data writing from the external connection terminals to the memory access means, whereby the data overwriting by the memory access means can be securely prevented as such driving electric power for data writing is not supplied to the memory access means.

[0091]

In the above-described head substrate, a specified one of the external connection terminals externally receives the access permission signal for permitting the data writing, while the memory access means executes data writing into the data memory means upon externally receiving the access permission signal from the external connection terminal, and the writing inhibition means cuts off the signal wiring for supplying the access permission signal for data writing from the external connection terminal to the memory access means, whereby the data overwriting by the memory access means can be securely prevented since the access permission signal required for data writing is not supplied to the memory access means.

[0092]

In the above-described head substrate, the memory access means writes data of plural kinds in succession into the data memory means, and the writing inhibition means individually disables the overwriting of the data of plural

kinds writing in succession into the data memory means by the memory access means, whereby the data of plural kinds can be written and overwriting can be disabled, at appropriate timings.

[0093]

In the above-described head substrate, at least a binary logic signal, the binary state of which corresponds to the presence or absence of the printing operation, a printing image signal and a printing clock signal are externally entered to the plurality of external connection terminals; the printing execution means initiates the printing operation when the printing image signal and the printing clock signal are externally entered to the external connection terminals while the binary logic signal in a first state is externally entered; and when the binary logic signal in a second state is externally entered to the external connection terminals, the memory access means performs data writing and data reading relative to the data memory means at the timing corresponding to a memory clock. Therefore, since an existing binary logic signal for the printing operation can be employed as an access permission signal for the memory access, the circuit configuration of the printer can be simplified.

[0094]

In the above-described head substrate, the printing

execution means prints a printing image signal serially entered to one specific external connection terminal; the memory access means writes, to the data memory means, write data serially received from the specific external connection terminal whereat the printing image signal is serially entered, and serially outputs read data obtained from the data memory means to the specific external connection terminal whereat the printing image signal is serially entered. Therefore, the input of the printing image signal and the output of the read data can be performed by using one external connection terminal.

[0095]

In the above-described head substrate, the printing execution means prints a printing image signal entered in parallel to multiple specific external connection terminals; the memory access means writes, to the data memory means, write data received in parallel from the specific external connection terminals whereat the printing image signal is entered in parallel, and outputs in parallel read data obtained from the data memory means to the specific external connection terminals whereat the printing image signal is entered in parallel. Therefore, the input of the printing image signal and the output of the read data can be performed at a high speed.

[0096]

In the above-described head substrate, the terminal sharing means transmits a printing clock signal of a shift register as a memory clock signal to the memory access means. Thus, an existing signal can be employed as a memory clock signal, and the circuit configuration of the printer can be simplified.

[0097]

According to the method of the invention for producing a head substrate and a printer head, the memory access means and the printing execution means are connected to a common external connection terminal by the terminal sharing means; and the data writing into the data memory means by the memory access means is permanently disabled after the completion of data writing into the data memory means by the memory access means, whereby it is rendered possible to produce a head substrate and a printer head in which the necessary data cannot be lost and can always be read exactly, since the data stored in the data memory means are not overwritten by the noise, eventually intruding into the memory access means from the external connection terminal, in case the printing operation is executed by mounting the printer head in the printer.

[0098]

In the producing method for the above-described head substrate and printer head, the electric power

wiring for supplying the driving electric power for data writing from the external connection terminals to the memory access means is cut off in order to permanently disable the data writing into the data memory means by the memory access means, whereby it is rendered possible to provide a head substrate and a printer head in which the data overwriting by the memory access means is securely prevented since the driving electric power required for data writing is not supplied to the memory access means.

[0099]

In the producing method for the above-described head substrate and printer head, the signal wiring connecting the external connection terminal, externally receiving the access permission signal for permitting the data writing, and the memory access means is cut off in order to permanently disable the data writing into the data memory means by the memory access means, whereby it is rendered possible to provide a head substrate and a printer head in which the data overwriting by the memory access means is securely prevented since the driving electric power required for data writing is not supplied to the memory access means.

[0100]

In the producing method for the above-described head substrate and printer head, the memory access means sequentially writes multiple types of data to the data memory means; and the memory access means disables the memory access means to overwrite the multiple types of data that have been sequentially written to the data

memory means, whereby, at an appropriate time, multiple types of write data can be written to the head substrate and the printer head and overwriting therefor can be disabled.

[0101]

A printer head according to the present invention, which is detachably mounted to a printer main body, comprises a head substrate according to the invention, so that the reduction of the size and the weight and the improvement of productivity can be implemented.

[0102]

According to the present invention, a printer comprises:

a printer head according to the present invention; printing input means for transmitting various signals to multiple external connection terminals of the printer head to permit printing execution means to perform a printing operation; and

memory reading means for transmitting various signals to the multiple external connection terminals of the printer head to permit the memory access means to perform data reading. Thus, the number of external connection terminals to be connected to the printer head can be reduced to implement the reduction of the size and the weight and the improvement of productivity, and the stored data can be always accurately read from the printer head.

[0103]

In the above described printer, the printing input means transmits, individually to the external

connection terminals of the printer head, various signals, such as a printing image signal and a printing clock signal, together with a binary logic signal in a first state; and the memory reading means transmits a memory clock signal, together with the binary logic signal in a second state, to the external connection terminals of the printer head. Therefore, since an existing binary logic signal for the printing operation can be used as an access permission signal for the memory access, the circuit structure for the printing input means and the memory reading means can be simplified.

[0104]

In the above described printer, the printing input means serially transmits the printing image signal to a specific external connection terminal; and the memory reading means serially receives read data obtained by the memory access means from the specific external connection terminal whereat the printing image signal is serially entered. Therefore, the transmission of the printing image signal and the reception of the read data can be performed by using one external connection terminal.

[0105]

In the above-described printer, the printing input means transmits the printing image signal in parallel to multiple specific external connection terminals; and the memory reading means receives read data obtained by the memory access means in parallel from the specific external connection terminals whereat the printing

image signal is entered in parallel. Therefore, the transmission of the printing image signal and the reception of the read data can be performed at a high speed.

[Brief Description of the Drawings]

[Fig. 1]

This is a block diagram showing the circuit configuration of a head substrate according to one embodiment of the present invention.

[Fig. 2]

This is an external perspective view of a printer.

[Fig. 3]

This is a schematic block diagram showing the circuit configuration of the printer.

[Fig. 4]

This is a schematic view showing the producing steps for the printer head, together with the state of use of the printer.

[Fig. 5]

This is a schematic view showing the producing steps for the printer head of a variation, together with the state of use of the printer.

[Description of Reference Numbers]

300: ink-jet printer as a printing apparatus

313: data input circuit as printing input means

314: data readout circuit as memory reading means

400: printer head

401: head substrate

410: base substrate

415, 416: heater power supply terminal

417: heater logic circuit

419: block terminal as an external connection
terminal

420: pulse terminal as an external connection
terminal

423: reset terminal as an external connection
terminal

424, 425: clock terminal as an external connection
terminal

426: data terminal as an external connection
terminal

431: sensor terminal as an external connection
terminal

432, 433: power supply terminal as an external
connection terminal

441: fuse ROM as data memory means

442: fuse logic circuit as memory access means

444: signal wiring as terminal sharing means

449: electric power fuse as writing inhibition
means

P: printing sheet as a recording medium

[Name of Document] Abstract

[Abstract]

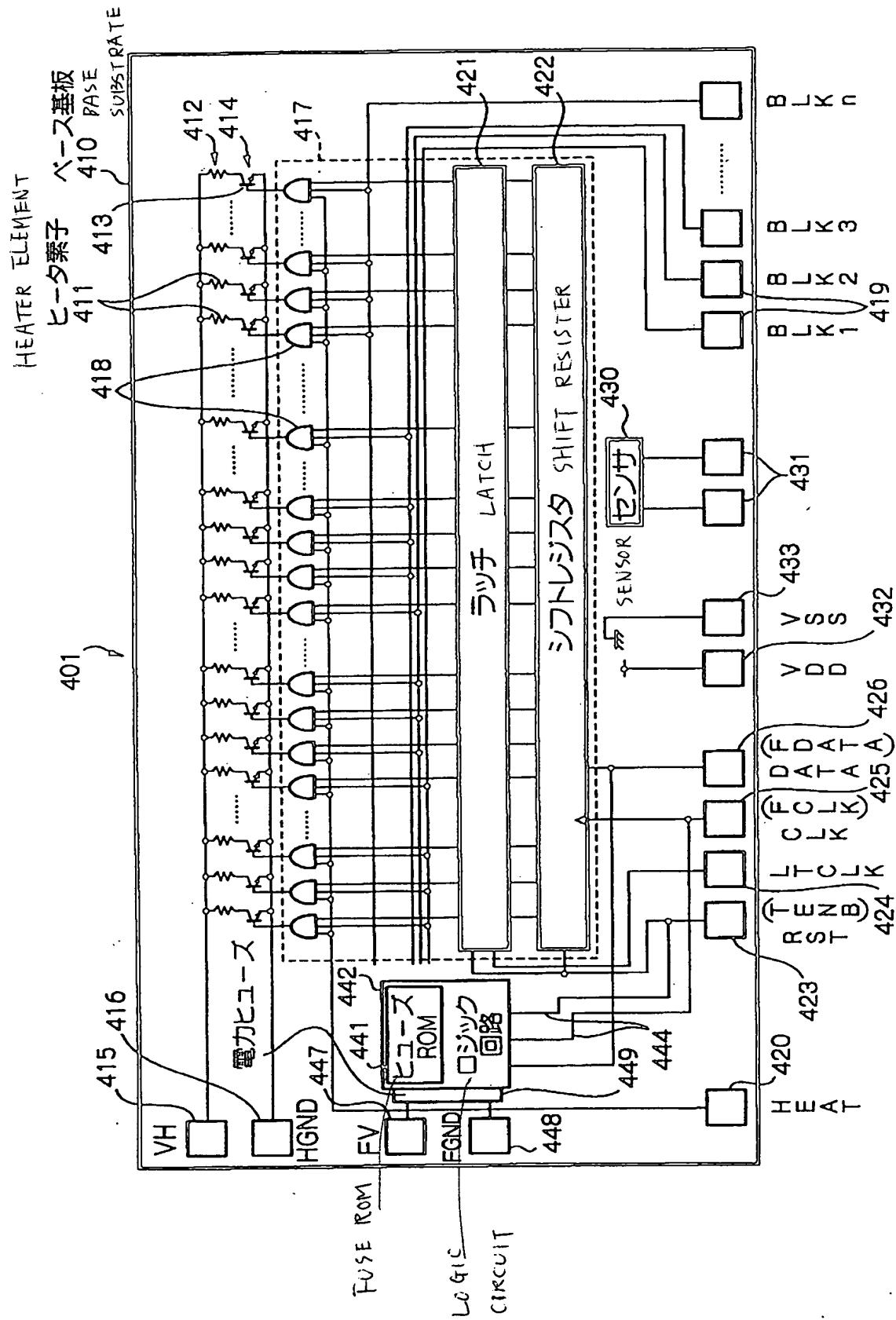
[Objective] One objective of the invention is to prevent overwriting of data stored in a data memory due to noise occurring during a printing operation, even when the data memory is mounted to a printer head and a printing mechanism and external connection terminals are used in common.

[Structure] Writing inhibition means 449 permanently disables data reading and writing means 442 to write data to data memory means 441.

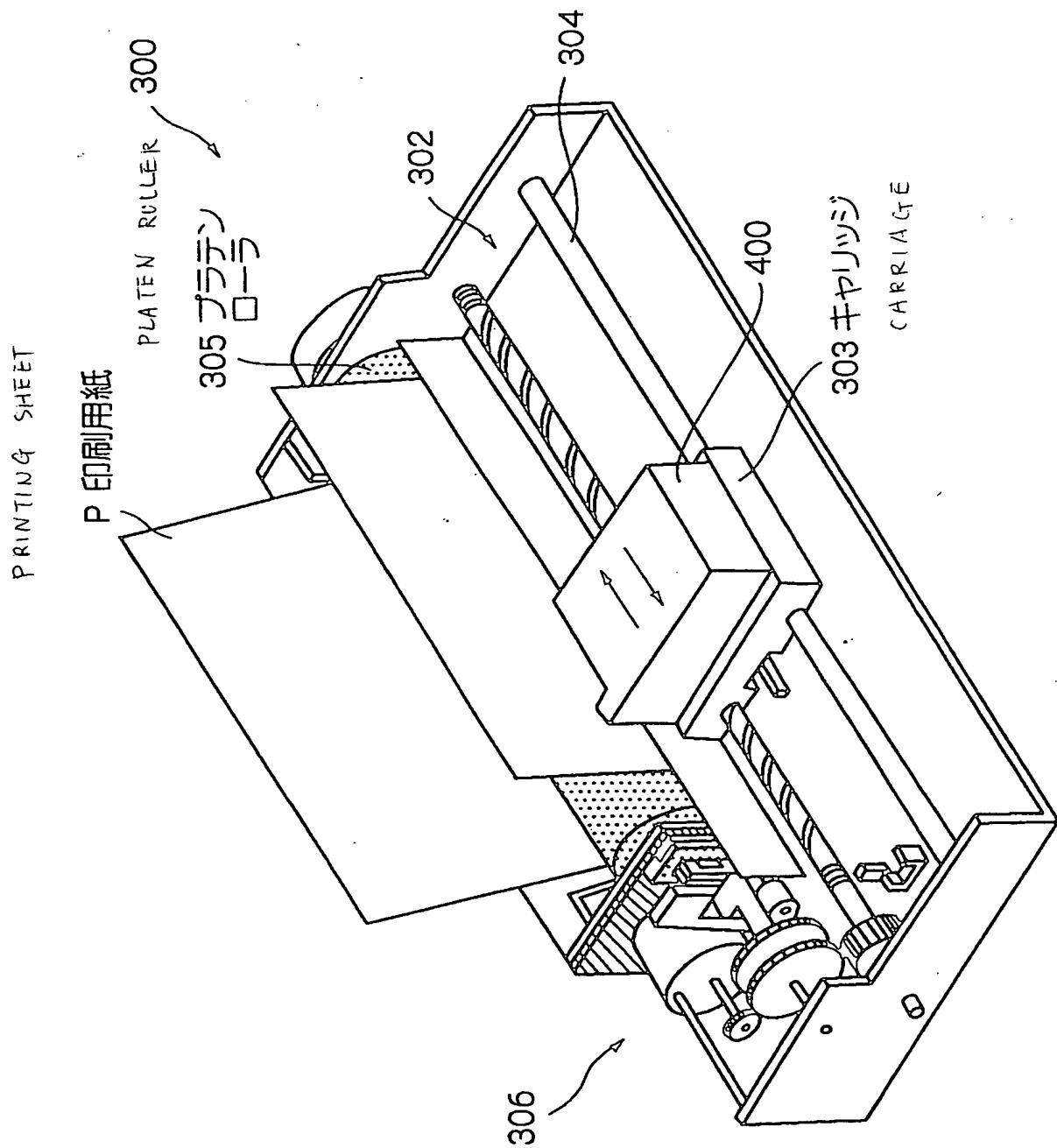
[Selected Figure] Fig. 1

【書類名】 図面 Name of Document

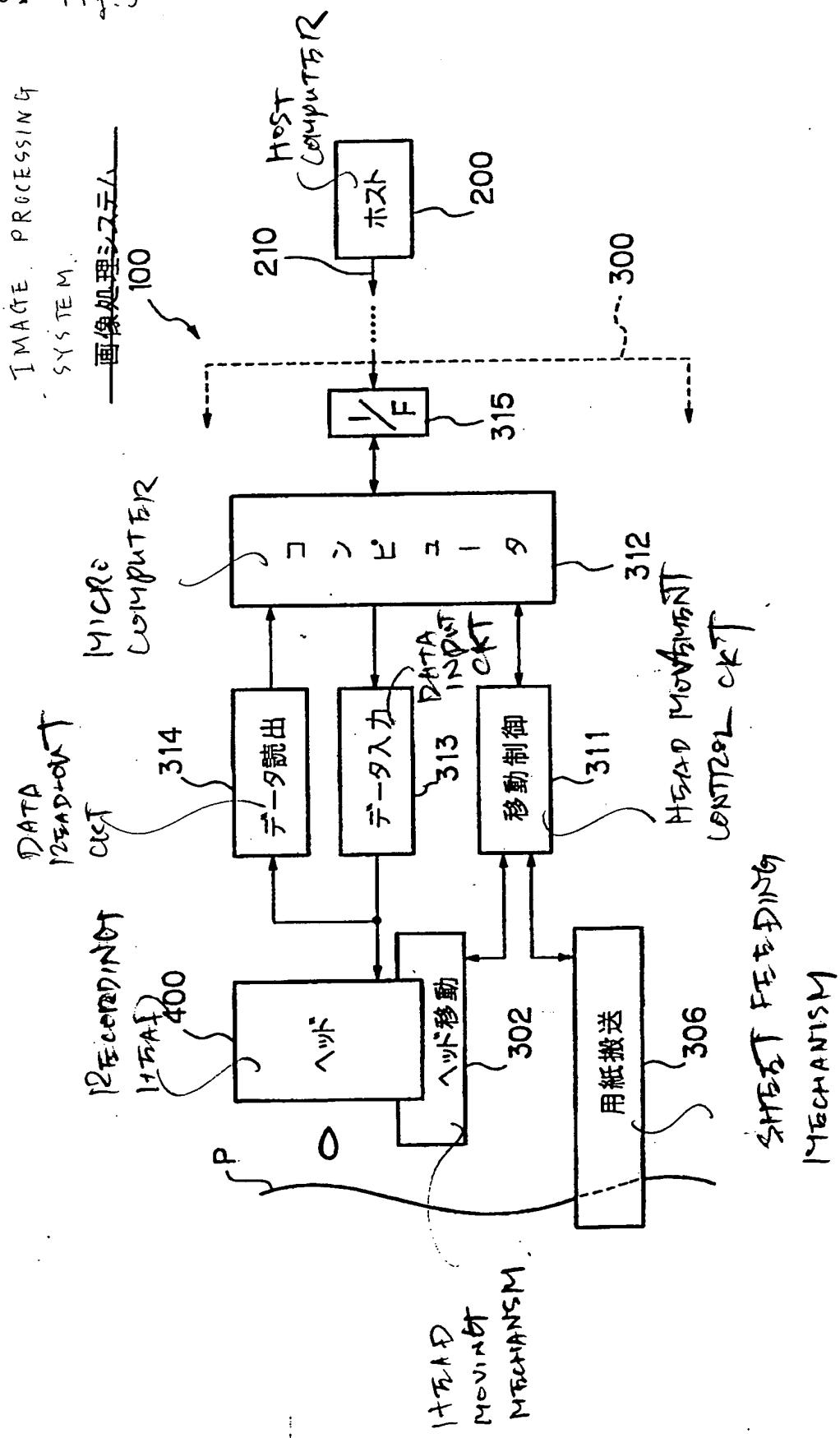
【図1】 Fig. 1 Drawings



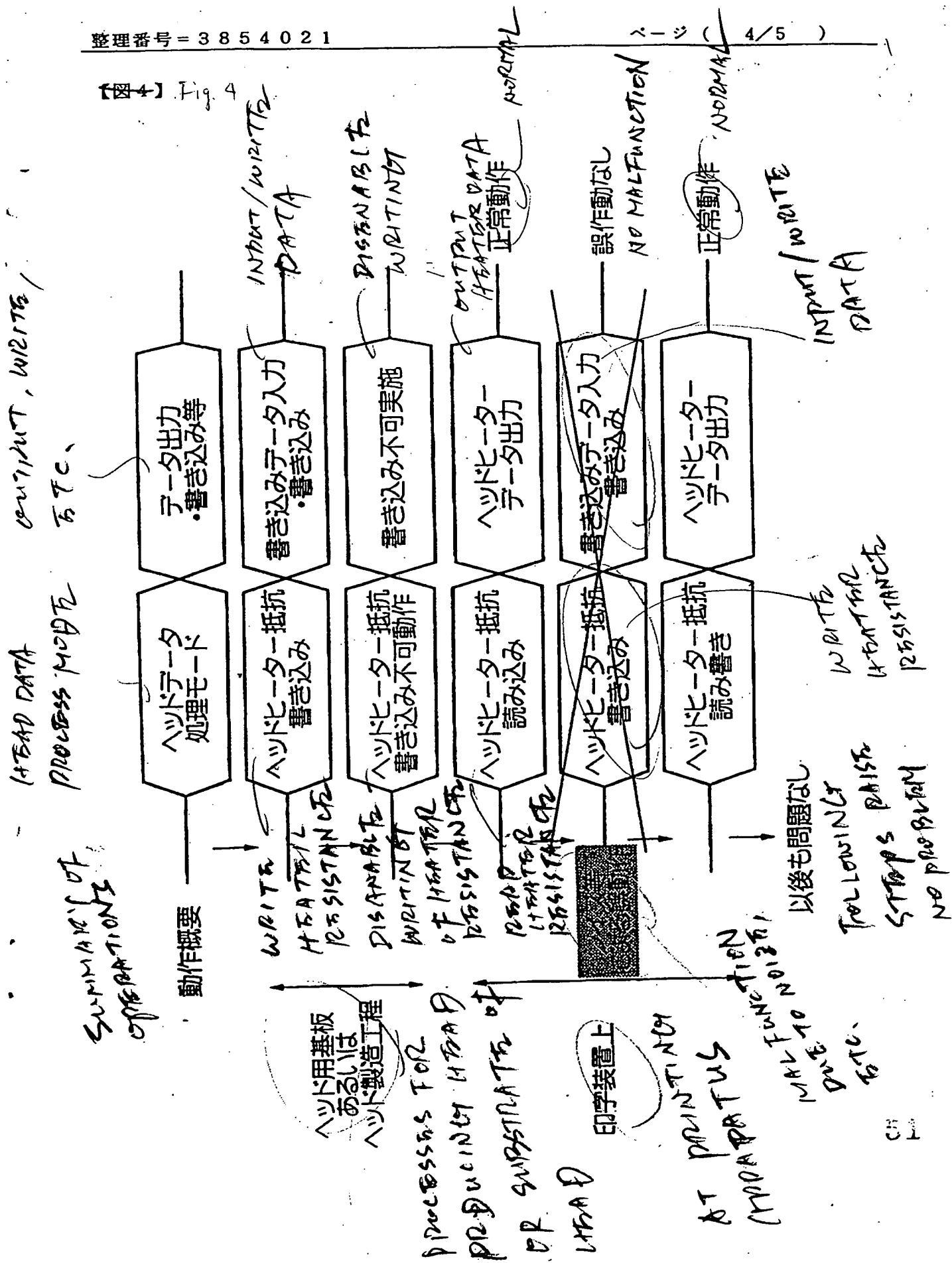
【図2】 Fig. 2

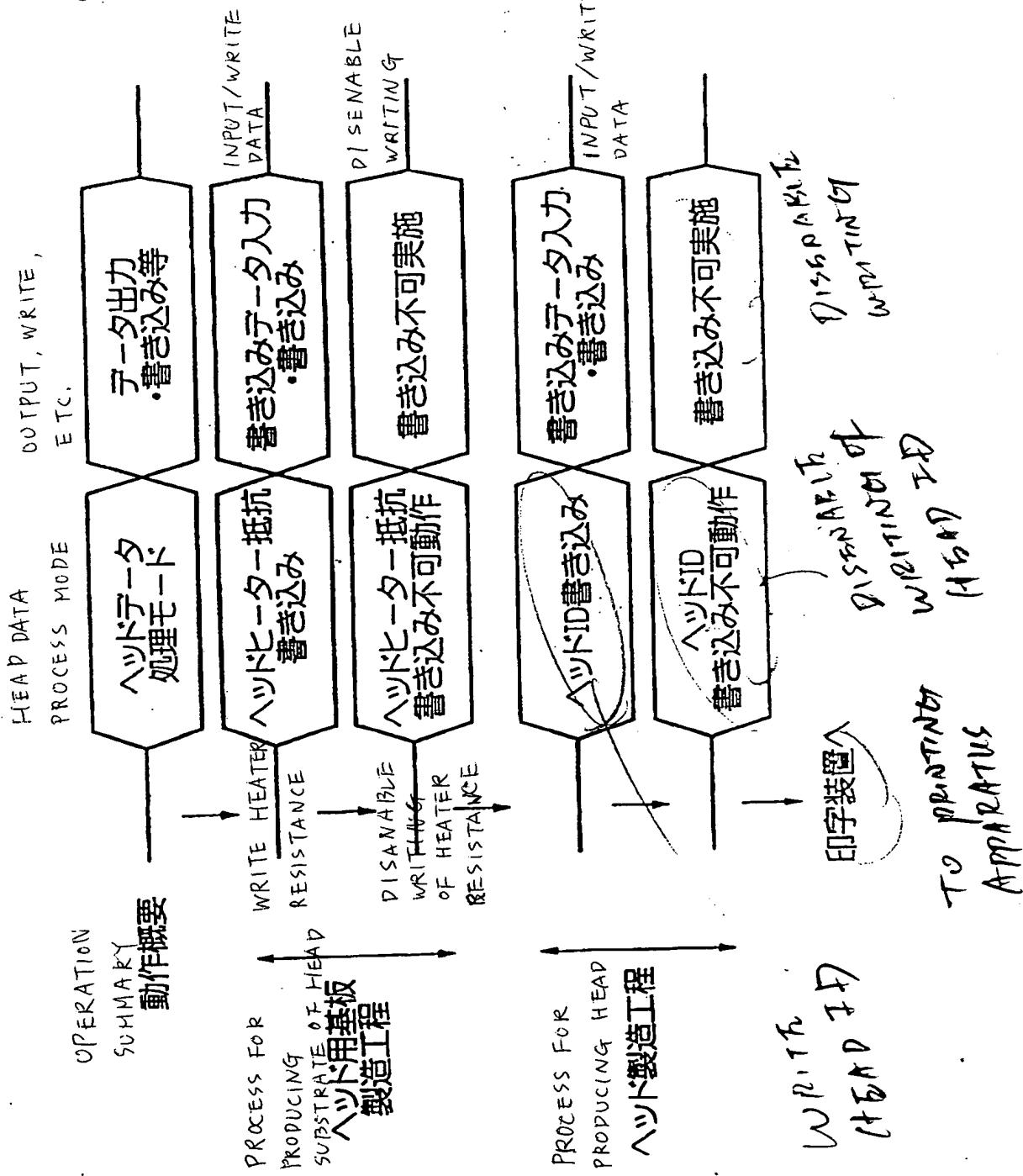


【図3】 Fig. 3



[图4] Fig. 4





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[Document to be corrected] Patent Application

<Recognition Information / Additional Information>

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